



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : James D. Hansen et al. Art Unit : 3732
Serial No. : 10/078,970 Examiner : Bumgarner, M.
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Title : ORTHODONTIC SEPARATORS

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DECLARATION OF TSI-ZONG TZOU UNDER 37 C.F.R. § 1.132

I, Tsi-Zong Tzou, declare as follows:

1. I am a citizen of the Republic of China and presently live at 713 Pamela Circle, Arcadia, California;
2. I received a Bachelor of Science degree in Chemical Engineering from National Taiwan University, Taipei, Taiwan in 1983, a Master of Science degree in Chemical Engineering from West Virginia University, Morgantown, West Virginia in 1985, and a Doctoral degree in Chemical Engineering from State University of New York at Buffalo, Buffalo, New York in 1989;
3. I was employed as a Senior Research Engineer at Cortec Corporation from 1990 to 1992;
4. I have been employed by 3M Company since 1992;
5. My current position is Product Development Specialist and that my responsibilities include developing orthodontic force modules and bonding adhesives;
6. A list of my articles, patents, and patent applications is attached.
7. Orthodontic separators are routinely used to increase the space between teeth before fitting orthodontic bands. Once inserted between adjacent teeth, the separator is under

compression, and due to its tendency to rebound, provides a force to separate the adjacent teeth. This compressive force decreases during the time when the separator is in use. Separators are usually left between adjacent teeth for about a week before fitting bands.

8. This invention describes orthodontic separators that exhibit an increase in compressive force when inserted between teeth in the oral environment. The increase in compressive force can be achieved by a separator of an O-ring or dog-bone shape that expands in the oral environment. After the expansion, a larger volume of such a separator is compressed between teeth, and as a result the compressive force increases. The contracted configuration of the separator before the expansion allows for easy insertion of the separator.

9. An O-ring shape is preferred because an O-ring encircles the contact point between adjacent teeth so that the pressure is distributed evenly over the entire O-ring and not concentrated only on the contact point. An O-ring better fits the space around the contact point, and therefore has less tendency to fall out over the extended time when the separator is used in patient's mouth.

10. A dog bone shape is also preferred. The middle section of the dog bone fits in the tightest space between adjacent teeth where the contact point is, and the end sections of the dog bones fit in the wider space around the contact point. Again the pressure is distributed over a larger area than just the contact point. And the better fit between the dog bone shape and the space around the contact point prevents the separator from falling out during extended time when the separator is in use.

11. The increase in compressive force can also be achieved by a separator of a coil or washer shape with shape memory metal alloys. When inserted in the oral environment, the separator changes its shape from a contracted configuration, e.g., flattened coil, to an expanded configuration, e.g., expanded coil. The expanded coil has a tendency to occupy a larger volume and is compressed between teeth, and as a result the compressive force increases.

12. A coil or washer shape is preferred for shape memory metal alloys because the separator in one shape, e.g., flattened coil, can be inserted between teeth easily, and the separator in another shape, e.g., expanded coil, exhibits an increase in compressive force when it is activated in the oral environment. A coil or washer shape allows the pressure to be distributed over a larger contact area than just the contact point between teeth, and has less tendency to fall out over the extended time when the separator is used in patient's mouth.

13. A dental wedge is not suitable for use as an orthodontic separator. The wedge shape does not conform to the interproximal space between adjacent teeth. Although the wedge shape allows an easy insertion through the apex prior to dental filling, it also allows easy removal in the reverse direction of insertion. Consequently, if a wedge shape were chosen for an orthodontic separator, the separator might fall out over the extended period time the separator is used in the patient's mouth. The separator is even more easily lost after the space between adjacent teeth increases over time. As the wedge-shaped separator is asymmetrical, and exerts pressure only on one side of the arch, the wedge shape may cause unwanted rotation over an extended period of time. Additionally, since the dental wedge protrudes beyond the interproximal space between adjacent teeth and causes irritation to surrounding tissues, it is not practical to leave it in the mouth for extended period of time.

14. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the instant patent application or any patent issuing thereon.

Dated: January 18, 2005

Tsi-Zong Tzou
Tsi-Zong Tzou

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